

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

## **IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

[MENU](#) | [SEARCH](#) | [INDEX](#) | [DETAIL](#) | [JAPANESE](#)

1 / 1

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-372668

(43)Date of publication of application : 26.12.2002

(51)Int.CI.

G02B 17/08  
G02B 13/14  
G02B 13/18  
G03F 7/20  
H01L 21/027

(21)Application number : 2001-179579

(71)Applicant : NIKON CORP

(22)Date of filing : 14.06.2001

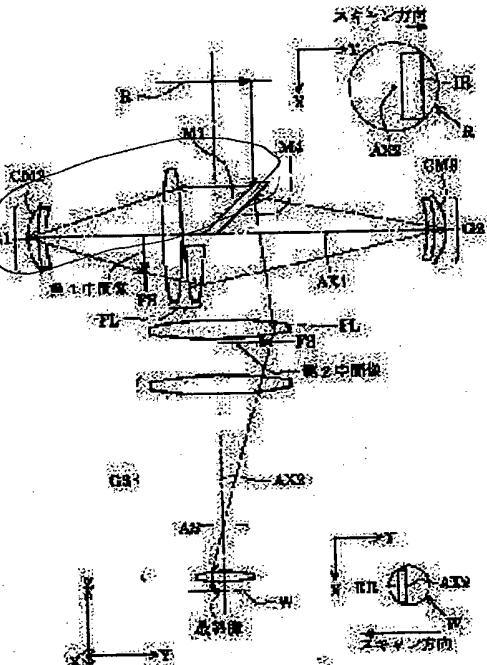
(72)Inventor : TAKAHASHI YUTO

### (54) CATADIORPTIC SYSTEM AND EXPOSURE DEVICE HAVING THIS CATADIORPTIC SYSTEM

#### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a catadioptric system which is small in the distance between an object surface and an image surface, has simple constitution of a small number of lens elements, is capable of achieving high resolution of  $\leq 0.1 \mu\text{m}$  by using light of a vacuum UV wavelength of, for example,  $\leq 80 \text{ nm}$ .

**SOLUTION:** This catadioptric system has a first imaging optical system (G1) which has a concave mirror (CM2) and a plane reflecting mirror (M1) and forms the first intermediate image of the first surface in accordance with the light from the first surface (R), a second imaging optical system (G2) which has a concave mirror (CM3) and a plane reflecting mirror (M4) and forms the second intermediate image of the first surface in accordance with the light through the first imaging optical system and the third imaging optical system (G3) of a refraction type which forms the final image of the first surface on the second surface (W) in accordance with the light through the second imaging optical system.



#### LEGAL STATUS

[Date of request for examination]



[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

1.20

2.21

## CLAIMS

---

[Claim(s)]

[Claim 1] Cata-dioptic system characterized by providing the following. The 1st image formation optical system for having at least one concave surface reflecting mirror and at least one plane mirror, and forming the 1st middle image of the 1st aforementioned page based on the light from the 1st page. The 2nd image formation optical system for forming the 2nd middle image of the 1st aforementioned page based on the light which has at least one concave surface reflecting mirror and at least one plane mirror, and minded the aforementioned 1st image formation optical system. The 3rd image formation optical system refraction type [ for forming the last image of the 1st aforementioned page on the 2nd page based on the light through the aforementioned 2nd image formation optical system ].

[Claim 2] All the optical faculty material except the plane mirror of the aforementioned 1st image formation optical system, and all the optical members except the plane mirror of the aforementioned 2nd image formation optical system It is arranged along with the 1st single optical axis prolonged in the shape of a straight line. all the optical members of the aforementioned 3rd image formation optical system It is arranged along with the 2nd single optical axis prolonged in the shape of a straight line so that it might intersect perpendicularly with the 1st optical axis of the above. the light from [ aforementioned ] the 1st page The light which formed the aforementioned 1st middle image through one plane mirror in the aforementioned 1st image formation optical system and one concave surface reflecting mirror one by one, and minded the aforementioned 1st image formation optical system Cata-dioptic system according to claim 1 characterized by forming the aforementioned 2nd middle image through one plane mirror of the aforementioned 2nd image formation optical system, and one concave surface reflecting mirror one by one.

[Claim 3] The aforementioned 1st image formation optical system is cata-dioptic system according to claim 2 characterized by having at least one negative-lens component arranged just before the aforementioned concave surface reflecting mirror.

[Claim 4] The aforementioned 2nd image formation optical system is cata-dioptic system according to claim 2 or 3 characterized by having at least one negative-lens component arranged just before the aforementioned lieberkuhn.

[Claim 5] Cata-dioptic system given in the claim 1 characterized by arranging the field lens in the optical path between the aforementioned 1st image formation optical system and the aforementioned 2nd image formation optical system, or any 1 term of 4.

[Claim 6] At least one lens in the aforementioned field lens arranged in the optical path between the aforementioned 1st image formation optical system and the aforementioned 2nd image formation optical system is cata-dioptic system according to claim 5 characterized by having the configuration which cut partially [ in order to pass only the reflected light from the aforementioned lieberkuhn, without passing the incident light to the aforementioned lieberkuhn of the aforementioned 1st image formation optical system ], and was lacked.

[Claim 7] At least one lens in the aforementioned field lens arranged in the optical path between the aforementioned 1st image formation optical system and the aforementioned 2nd image formation optical system is [ both ] cata-dioptic system according to claim 5 or 6 characterized by being formed so that the incident light to the aforementioned lieberkuhn of the aforementioned 1st image formation optical system and the reflected light from the aforementioned lieberkuhn may be passed.

[Claim 8] Cata-dioptic system given in the claim 1 characterized by arranging the field lens

in the optical path between the aforementioned 2nd image formation optical system and the aforementioned 3rd image formation optical system, or any 1 term of 7.

[Claim 9] The aligner characterized by equipping with the cata-dioptic system of a publication the claim 1 for forming the image of the pattern formed in the illumination system and the aforementioned mask for illuminating the mask set as the 1st aforementioned page on the photosensitive substrate set as the 2nd aforementioned page, or any 1 term of 8.

